



# OLR RESEARCH REPORT

November 19, 2012

2012-R-0478

## **OLR BACKGROUNDER: PROMOTING NATURAL GAS USE IN CONNECTICUT — POTENTIAL BENEFITS, COSTS, RISKS, AND UNCERTAINTIES**

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This report discusses the potential benefits, costs, risks, and uncertainties of promoting natural gas use in Connecticut. It does so primarily with reference to recommendations of the draft comprehensive energy [strategy](#) issued by the Department of Energy and Environmental Protection (DEEP).

### **SUMMARY**

The draft strategy, issued in October 2012, recommends increased use of natural gas in the state, primarily for heating buildings. It also recommends using natural gas in certain vehicle fleets.

The strategy puts forward a seven-year plan to expand natural gas use across Connecticut with a goal of providing nearly 300,000 Connecticut homes, businesses, and other facilities with access to gas. It recommends, among other things:

1. providing financing to homeowners and businesses to eliminate the upfront cost of converting heating equipment and appliances to natural gas, with the cost initially funded by banks and capital markets and repaid back over 10 years through the customer's gas bill;

2. lengthening the period in which distribution system expansions must pay for themselves, to enable potential gas customers who are near gas mains to have their connections financed by the gas companies and repaid through the added revenues of the new customers; and
3. encouraging the construction of approximately 900 miles of gas mains, with a particular focus on providing “anchor loads” such as factories, hospitals, and schools with significant energy consumption with access to gas mains.

In the transportation sector, the draft strategy recommends:

1. support for converting delivery vans, taxis, and public works vehicle fleets to natural gas in conjunction with private sector-funded construction of natural gas filling stations that will also be open to the public and
2. establishment of a set of liquefied natural gas (LNG) stations at truck stops to support the conversion of truck fleets to natural gas.

The major benefits of promoting gas use in Connecticut are economic. Currently, gas costs substantially less than heating oil and it appears likely that this will remain the case for some time. In addition to saving individual customers money, promoting gas use could benefit the state's economy as the money saved in heating costs would be recycled in purchases of goods and services in the state. Increased gas use would also provide environmental benefits in terms of reduced air emissions.

However, promoting gas use, particularly for consumers who are not on gas distribution mains, would have significant costs. Encouraging fuel switching would also harm some fuel oil dealers who would lose customers.

In some ways, promoting natural gas use would benefit some individuals while imposing costs on others. For example, low-income residential customers who switched from heating oil to gas would benefit from the statutory prohibition on service terminations during the heating season. However, the cost of this protection would be borne by other gas customers.

In addition to benefits and costs, promoting increased use of natural gas in the state is subject to uncertainties and risks. As used in this report, an uncertain event is one that may or may not occur in the future. Risk refers to events that are likely to occur, e.g., changes in energy costs, but whose direction is unknown. Among the risks are that:

1. the current price advantage of gas over heating oil could substantially decline over time;
2. fewer customers than projected could switch from oil to gas, thereby exposing gas ratepayers to higher distribution costs; and
3. the state's large and increasing reliance on gas to fuel power plants could lead to conflicting demands during a severe cold wave.

The benefits and costs identified in the draft strategy are similar to those described in a 2011 [study](#) by the Department of Economic and Community Development (DECD) that was sponsored by the state's three gas companies. The study concludes that substantially expanding gas use in the state would result in significant net benefits.

## **BACKGROUND**

[PA 11-80](#) requires DEEP to develop a comprehensive plan (which it calls a strategy) that incorporates existing energy efficiency and renewable energy plans. DEEP must consult with the Connecticut Energy Advisory Board (CEAB) in developing the plan.

Under the act, the plan must include, among other things:

1. an assessment and plan for all energy needs, including electricity, heating, cooling, and transportation;
2. an assessment of energy supplies, demands, and costs, and factors likely to affect them;
3. long-range energy policies to achieve a sound economy and the least-cost mix of energy supply sources and measures that reduce energy demand, considering such factors as price impacts, public health, and environmental goals;
4. recommendations for administrative and legislative action;

5. an assessment of the potential costs savings and benefits to ratepayers, including carbon dioxide emissions; and
6. the benefits, costs, obstacles, and solutions related to expanding the use of natural gas for transportation purposes.

If DEEP finds that expanding the use of natural gas is in the public interest it must also develop a plan to increase its availability and use for transportation.

The act requires the Public Utilities Regulatory Authority (PURA, formerly the Department of Public Utility Control) to provide input on the proposed plan's impact on ratepayers, and allows the public to comment on it during a 45-day comment period. DEEP will accept comments on the draft strategy until December 14, 2012. A DEEP [webpage](#) describes how to file comments electronically. Once the plan is finalized, the DEEP commissioner must publish the plan electronically and summarize all public comments and any changes that resulted from them.

The commissioner must submit the plan to the General Assembly's committees on energy and the environment. He can subsequently modify the plan in consultation with CEAB under the same procedures the act requires for the initial plan.

## **DRAFT COMPREHENSIVE ENERGY STRATEGY**

The draft strategy offers recommendations in five areas, energy efficiency, electricity supply, industrial energy needs, transportation, and natural gas. Among other things, the draft strategy seeks to align Connecticut's energy future with the emerging opportunity provided by shale gas for a lower-cost, less-polluting, and domestically available energy supply. The strategy puts forward a seven-year plan to expand natural gas use across Connecticut with a goal of providing nearly 300,000 Connecticut homes, businesses, and other facilities with access to gas.

### ***Natural Gas***

The report notes that over the last several years, the price of natural gas and heating oil have diverged, or "decoupled," from one another. The emergence of new extraction techniques, notably hydraulic fracturing ("fracking") have brought enormous amounts of natural gas supply to the marketplace from Marcellus basins in the northeast and other parts of the country. As a result, the average wholesale price of natural gas has

dropped from over \$7 per million British Thermal Units (BTUs) in 2007 to below \$3 per million BTU in early 2012, with prices projected to remain low for the foreseeable future. In that same time, the average wholesale price of oil rose from \$12 to over \$16 per million BTU (averaging \$96 per barrel in early 2012), and is projected to remain high due to growing global demand for oil, especially in emerging markets such as China and India.

In spite of the price difference, only 31% of the state's residents currently use natural gas for space heating. That percentage is lower than the rest of New England and the U.S. average, which are about 50%. The draft strategy argues that the primary reason that so few customers heat with natural gas is the significant upfront cost of installing natural gas heating equipment. In addition, for homes and businesses located more than 150 feet from a gas main, the cost of extending the main may substantially exceed the cost of the new heating equipment.

The draft strategy argues that Connecticut residents and business owners have an opportunity to switch to a cheaper, cleaner fuel source, and lower their energy bills while decreasing the level of air pollution. Its recommendations are to:

1. provide financing to homeowners and businesses to eliminate the upfront cost of converting furnaces, boilers, and other appliances to natural gas, with the cost initially funded by banks and capital markets and repaid over 10 years through the customer's gas bill;
2. offer alternative financing for low-income homeowners through community banks and credit unions with the state providing incentives or financing through the Clean Energy Finance and Investment Authority;
3. make regulatory changes, such as lengthening the period in which systems expansions must pay for themselves, to enable potential gas customers who are near gas mains to have their connections financed by the gas companies and repaid through the added revenues of the new customers; and
4. encourage the construction of approximately 900 miles of gas mains, focusing on giving access to gas mains to "anchor loads" such as factories, hospitals, schools, or other facilities with significant energy consumption.

DEEP estimates that more than half (52%) of residential and 75% of commercial and industrial oil customers are plausible candidates for switching to natural gas. DEEP splits these customers into two groups. The first consists of customers who (1) already use gas for cooking or water heating but have oil space heating systems or (2) do not currently use gas but are on or within 150 feet of gas mains. The draft strategy estimates that there are approximately 200,000 residential and 16,700 commercial and industrial customers in this group. The second group consists of customers who are not served by gas and are more than 150 feet away from a gas main but who could economically be served with extensions of mains. The draft strategy estimates that there are approximately 51,500 residential and 37,700 commercial and industrial customers in this category.

Another chapter of the draft strategy addresses energy issues in the transportation sector. It notes that of the current 2.5 million vehicles registered in Connecticut, fewer than 1,680 are currently powered by natural gas or other alternative fuels. The draft strategy argues that reducing the amount of gasoline consumed in Connecticut would bring significant economic benefits, most notably potential lower costs and fewer dollars shipped overseas. For example, natural gas currently costs about one-third as much as diesel fuel. In addition, reducing oil consumption would have environmental and public health benefits, including improved air quality and lower greenhouse gas emissions.

While there are significant obstacles to a clean fuels/clean vehicles future, the draft strategy argues that the state is well positioned to be a test bed for such fuels and vehicles. It proposes building a diverse refueling infrastructure so that fuel choices are made by, rather than for, Connecticut drivers. This infrastructure may include alternative fueling stations including compressed natural gas (CNG), electric, E-85 (made up of 85% ethanol alcohol and 15% gasoline), liquefied natural gas (LNG), propane, and hydrogen stations.

The most appropriate type of alternative fuel varies by vehicle type. For example, the draft strategy argues that natural gas is an economically viable option for fleets such as buses, garbage trucks, and taxis that regularly return to a central location for fueling. It notes that the towns of Fairfield, Stratford, and Trumbull have purchased CNG-powered vehicles, which save the towns from purchasing thousands of gallons of gas each year, and result in tens of tons of fewer greenhouse gas emissions.

The draft strategy proposes (1) that DEEP develop a pilot program to support the conversion of fleet vehicles to natural gas vehicles and (2) the construction of a network of publicly available LNG and CNG filling stations. It also recommends that the Public Utilities Regulatory Authority (PURA, formerly the Department of Public Utility Control) use of firm rather than interruptible rates to base the price of natural gas vehicle fuel rather than linking it to the price of gasoline, thereby providing a clearer price signal that will encourage greater use of natural gas vehicles.

In 2011, the state's three gas companies commissioned DECD to perform an economic analysis of a gas main expansion scenario leading to increased customer conversions from oil heat to natural gas heat. The build out and conversion period would occur between 2012 and 2021 during which there is significant construction and changeover from oil to natural gas space and water heating equipment. The DECD analysis assumes that the gas companies would pay for the infrastructure build out and home and business owners would pay for equipment conversion.

### **POTENTIAL BENEFITS OF EXPANDING GAS USE**

The strategy's primary argument for promoting natural gas use is economic. When the draft strategy was being prepared, the average homeowner heating with natural gas paid 54% (\$1,800) less each year to heat his or her home than the average homeowner heating with fuel oil. For commercial businesses, natural gas was 58% (\$3,300) cheaper to heat with than fuel oil. Annual energy bills for industrial customers heating with natural gas were 74% (\$25,000) lower than for their oil-heating competitors.

DEEP estimated the net present value (NPV) of converting the two customer groups that are plausible candidates for fuel switching. To calculate the NPV of natural gas conversion for the draft strategy, DEEP estimated the conversion costs for each group (including the cost of the replacement heating equipment, service lines and meters, and extensions of distribution lines) and the savings over 20 years. DEEP used a discount rate of 5% applied to the savings estimate, to bring it to present value. DEEP calculated the savings based on projected fuel prices in the reference case for the New England region presented in the 2012 Annual Energy Outlook produced by the U.S. Energy Information Administration (EIA). EIA projects that natural gas prices will rise by 2.1% per year from 2010 through 2035, to an annual average of \$7.37 per million BTU (2010 dollars) by 2035, and that oil prices will remain at least three times higher than natural gas prices through that period.

The analysis finds that converting both groups to natural gas would provide approximately \$2.8 billion in net savings over 20 years. Of this amount \$2.6 billion would be realized by customers who only use gas for non-heating purposes or who are not currently customers but are within 150 feet of an existing main.

Connecticut residents would be put to work building the needed infrastructure for an expansion, and the economy would get a boost from the savings in energy costs being spent on other goods and services, instead of energy. In addition, there would be wider benefits to the country as a whole from energy dollars being spent on a domestic energy source instead of on foreign oil.

While the draft strategy does not quantify these benefits, the DECD study estimates that a set of fuel switching initiatives would result in a net increase in jobs, state gross domestic product, and state tax revenues. From 2012 through 2021, the initiatives proposed in the DECD study would result in:

1. a total of 54,000 job-years of net total employment (8,000 jobs per year in the first five years and 3,100 jobs per year in the next five years);
2. \$4.1 billion of increased net GDP over the expansion period (\$2.8 billion in the first five years); and
3. \$400 million of increased state revenue (most realized in the first five years).

These estimates take into account the loss of employment and revenue incurred by heating oil dealers and related employers as a result of fuel switching. Neither the draft strategy nor the DECD study estimate the impact of promoting gas use on municipalities, but there would be property tax gains on the expanded gas distribution system.

Fuel switching would also bring environmental gains, lowering emissions of pollutants such as sulfur and nitrogen oxides (SO<sub>x</sub> and NO<sub>x</sub>) and particulate matter (soot). According to the strategy, burning natural gas instead of fuel oil for heating, or in place of gasoline or diesel fuel for transportation, can reduce emissions of NO<sub>x</sub> by 20-50%, SO<sub>x</sub> by up to 99%, and carbon dioxide emissions by up to 25-27%. Emissions of particulate matter are typically reduced as well, but the amount of reduction depends on the specific application.



## **POTENTIAL COSTS**

The measures promoting gas use proposed in the draft strategy have very high costs, although the plan projects they would have a substantial net benefit. For existing and potential customers who are currently on or near distribution mains, the draft plan anticipates the cost of the replacement heating equipment at approximately \$1.84 billion over the life of the initiative, with service lines and meters costing an additional \$815 million more. For potential customers located away from distribution mains, the projected costs are \$1.16 billion for replacement heating equipment, \$512 million for service lines and meters, and \$926 million for distribution main extensions. The draft strategy estimates that the cost of main extensions is about \$1 million per mile, or about \$190 per foot, although these costs can vary significantly.

The draft strategy proposes financing these costs using investments from Connecticut gas companies, new and existing gas customers, and private capital. It also argues that where fuel switching promises to produce broader societal benefits, using tax revenues may also be appropriate.

Promoting fuel switching would negatively affect the state's home heating industry. Substantially reducing demand for heating oil would result in layoffs and potentially the closure of some dealers.

As noted above, promoting natural gas use would have environmental benefits. But the reductions in air pollution described above do not consider the potential environmental impacts occurring where the natural gas is produced or the potential for leakage of methane (a greenhouse gas that is the primary constituent of natural gas) from natural gas pipelines as the gas is transmitted to Connecticut. Some studies have characterized these impacts as minor or manageable, while others suggest they could potentially offset any end-use greenhouse gas emissions reduction. As the impacts of drilling and transport emissions of natural gas relative to fuel oil are unclear at this time, DEEP did not adjust the figures used in the draft strategy for air pollution reductions.

## **RISKS**

### ***Price Changes***

The draft strategy acknowledges a number of risks to promoting gas use. Natural gas prices rose while the draft strategy was being developed and could rise beyond the levels projected in the strategy, further narrowing the gap with oil prices. This could result from several factors. Demand for natural gas could rise as more electric generation switches from coal or oil to natural gas. Expanding natural gas exports could redirect United States gas supplies to markets in Asia and Europe where gas prices are several times higher, driving up the price of natural gas in the United States. Additionally, reserves could prove more difficult to access than currently thought. Potential negative environmental impacts from fracking, such as groundwater contamination, methane leakage, or other damage to the environment or public health could result in regulatory changes that could slow the pace of drilling and drive up the costs in order to address these issues. The draft strategy conducted sensitivity analyses of its projections and estimated that a high gas cost scenario reduced the net present value of the initiatives by 11% for customers located on or near existing distribution mains and by 73% for customers who would need main extensions.

### ***Impact on Electricity Generation***

One risk results from the interaction between natural gas and electricity generation. In Connecticut and elsewhere in the Northeast, a growing share of power plants and smaller distributed generation facilities use natural gas as their fuel. Generally, these facilities buy gas under interruptible contracts and can be denied service during peak demands. In contrast, residential and most small business customers buy gas under firm contracts, where their suppliers must meet their demand at all times.

According to PURA, when the weather is very cold, the pipelines implement more stringent operating procedures such as operational flow orders. This makes it difficult for gas-fired power generators without firm transportation contracts to obtain gas for delivery. Additionally, hourly flow limits are affected during very cold weather. Similarly, during extremely hot summer days, the pipelines are run at very high capacity levels and issue operational flow orders that restrict shippers to stay within strict limits.

Given the supply constraints on the pipeline system, there is a risk that existing electric facilities would not be supplied during extreme weather. Unless there is a substantial expansion of the capacity of the pipeline system, this risk would be exacerbated by increasing demand by other customers, as contemplated by the draft strategy. In addition to the other consequences of potential blackouts, most heating equipment uses electronic ignition and therefore electric outages would also result in substantial numbers of residents and businesses losing their heat.

The potential competition for gas supply could also be affected by retirements of existing oil- and coal-fueled power plants. PURA anticipates that as much as 3,236 megawatts (MW) of generating capacity could retire in New England, mostly by 2015. Of this amount, 1,549 MW comes from planned retirements and an additional 1,687 MW of retirements as new air quality regulations make existing plants more expensive to run. If all of these retirements occur and are replaced with gas-fired generation, New England's consumption of gas for electric generation would significantly increase. These new generation facilities would need approximately 21% of the existing pipeline capacity serving New England. PURA believes that serving the new gas-fired generation during the winter would not be possible without significant infrastructure improvements on the pipelines.

ISO-NE (Independent System Operator-New England), the entity that regulates the regional electrical grid, has [proposed](#) short and long-term changes to the regional power system's operations aimed at addressing some of these risks to the electrical system. In the short-term, ISO-NE is considering implementing a supplemental procurement to assure that a sufficient minimum of electricity generators maintain either an adequate level of local liquid fuel inventory (e.g., oil or liquefied natural gas), or access to no-notice, firm gas supply. Payments for the procurement would be paired with performance penalties for failure to meet required operating standards. While this proposal is currently under consideration, ISO-NE hopes to begin implementing it by the summer of 2013.

In the long-term, ISO-NE has proposed changes to the Forward Capacity and Forward Reserve markets to create better incentives for generators to make alternative fuel arrangements or enter into firm gas transportation contracts. In general these changes would include market incentives to encourage adequate levels of firm fuel supply and penalties for a generator's failure to perform. These changes are unlikely to be implemented before Forward Capacity Auction 9, when electric companies and suppliers will purchase resources for capacity years 2018-2019. However, the ISO-NE proposal also suggests that a

commitment to increasing generators' firm gas commitments could help trigger gas pipeline expansion, which would also help lessen the threat of fuel disruptions for gas fired generators.

### ***Transportation***

With regard to the transportation sector, PURA anticipates that significant capital investment in infrastructure and associated facilities would be required to make natural gas a viable fuel source. PURA has expressed concern that this infrastructure investment would pose significant risk to the gas companies and would likely end up being subsidized by ratepayers through higher rates. PURA believes that gas company shareholders rather than ratepayers should make these investments and bear the associated risks.

### **UNCERTAINTIES**

Perhaps the greatest uncertainty associated with the draft strategy is whether pipeline capacity will expand to meet the increased demand contemplated in the strategy. According to PURA, such incremental capacity is currently unavailable, and a proposed expansion of the Algonquin pipeline that would enable gas supplies to be shipped from the Marcellus shale region will not be in service until November 2015 at the earliest. The Williams Pipeline Company's has proposed building the Constitution Pipeline to bring Marcellus shale gas to the existing Iroquois pipeline and then transported into Connecticut, New York City, and Long Island but it is unclear whether this project will go forward and if so, when.

PURA also notes that recent additions of large gas-fired electric generation plants and distributed generation units have significantly increased natural gas demand, which further limits capacity of the pipelines to serve residential heating and other "firm" customers.

A related uncertainty, raised by the Office of Consumer Counsel in their comments filed during the drafting of the strategy, is the extent to which new gas-fired power plants are built in the northeast and oil heat customers in the region switch to gas. This will affect the availability of gas to serve Connecticut but is beyond the jurisdiction of Connecticut decision-makers.

In the transportation sector, it unclear whether vehicle manufacturers will make large numbers of natural gas vehicles in the absence of an extensive fueling infrastructure. While the draft strategy focuses on centrally-fueled fleet vehicles, it is unclear whether this market is large enough to allow vehicle manufacturers to recoup their costs in developing natural gas-powered vehicles for these fleets.

## **INTERNET SOURCES CITED**

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